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ABSTRACT

Reported is an evaluation study of elementary school children's achievement of Science A Process Approach (SAPA) in grade four. A group test consisting of several tasks, providing immediate feedback on overall class performance was undertaken. The tasks focused on behaviors and provided for assessment of transfer of learning and ability to generalize. Pupils from 21 fourth grade classrooms and 11 different teachers participated. SAPA was originally designed so that 90 percent of the pupils should achieve 90 percent of the stated objectives. There had been no extensive published evaluation of the final version of Part E, but it was reported that it was less successful than Parts A through D. The average percentage for this group of students was 82, indicating that the objectives of the program were being achieved. (EB)

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PUPIL ACHIEVEMENT IN SCIENCE A PROCESS APPROACH - PART E

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The problem considered in this study was to determine to what extent elementary school children were achieving the objectives of Science A Process Approach[1] (SAPA) in Grade Four. SAPA is a sequential general science program for grades kindergarten through six. In the primary grades attention is focused on the basic scientific processes of observing, inferring, classifying, using numbers, measuring, using space/time relationships, communicating, and predicting. The intermediate grades focus on the integrated processes of defining operationally, formulating hypotheses, controlling variables, interpreting data, and experimenting.

Each exercise is organized around one of these processes and its related skills. These skills are defined in terms of observable performances or behaviors of the pupil and are the behavioral objectives found on the cover of each teacher booklet prepared for each exercise. Except for certain data sheets there are no printed materials prepared for the pupils. Together the exercises form a hierarchy in which one process contributes to the pupil's capabilities in other processes. Although the exercises should not be used out of sequence, the teacher is free to handle the lessons in any way that will achieve the specified outcomes.

The teacher booklets also contain, for each exercise, a rationale, vocabulary, list of required materials, instructional procedure, a generalizing experience, appraisal, and competency measure. The instructional procedure is the general teaching methods suggested for each of several activities in the exercise.

Evaluation is an important part of the SAPA program. The appraisal is a group test that provides immediate feedback on overall class performance. Competency measures are individual

achievement tests of several tasks ranging in number from two to fourteen. Each task assesses the attainment of one or more of the behavioral objectives listed for the exercise and the tasks are so labeled. These tasks have been carefully tested with tryout groups involving 7000 children over a three year period.[2] The tasks are intentionally designed to use content material different from that of the exercise. The tasks focus on observable behaviors rather than the recall of memorized facts or the recognition of familiar objects. In this way, one can assess the transfer of learning and ability to generalize. The individual competency measures are the instruments administered in this study.

Procedure

The subjects were fourth grade pupils in the seven elementary schools of Marple-Newtown School District, Newtown Square, Pennsylvania, during the school year 1970-1971. The Marple-Newtown School District is coterminous with the Townships of Marple and Newtown, located approximately twelve miles west of Philadelphia in Northeastern Delaware County. The 1970-1971 school facilities consisted of seven elementary schools, two junior high schools, and one senior high school. Enrollment in the ten schools was more than 7800 students. The school district is almost entirely residential with supporting service activities and little industry. The resident population of 38,000 is largely business and professional people with well over seventy percent having completed some kind of post-secondary education. Approximately half the employed persons leave the district for employment, the majority commuting to Philadelphia. Incomes are

well above the state average. Housing is predominately single-family, owner-occupied units although the supply of apartments is increasing. Racially, the population is almost entirely white.

Beginning with Part A in kindergarten, during the school year 1966-1967, the SAPA program was installed in the Marple-Newtown School District by adding one grade each year as the pupils progressed through the program. Thus, during the year of the study, 1970-1971, the SAPA program was functioning in grades kindergarten through four. This was the first year of the program in grade four.

The teachers were given a sheet with a list of random numbers[3] and asked to copy their roll, in alphabetical order, on this sheet. They were then asked to administer the individual competency measure tasks for the first exercise taught to the pupils whose names appeared after numbers one and two on the sheet. For the second exercise taught the teachers were asked to administer the competency measure to pupils numbered three and four, and so on through the list for the other exercises as they were completed. If a number was blank (no pupil's name next to it), the teachers were instructed to go on to the next number. Two pupils, selected in this random fashion, in each class for each SAPA exercise taught, were given the competency measure for the particular exercise. This involved 810 competency measures given in twenty-one fourth grade classrooms by eleven different teachers between September, 1970 and June, 1971. It was during this time period that the investigator[4] served as an Elementary Science Consultant in the Marple-Newtown School District.

Results

Percentages of correct responses were computed for individual exercises in Part E. The average percentage of correct responses in the fourth grade was 82%. These results are summarized in Table I.

Percentages of correct responses were also computed for individual exercises in Parts A through D. These results are summarized in Table II and are included for comparison purposes. Similar results have been previously reported.[5]

Limitations of the Study

The major limitation of this investigation was that each teacher administered the competency measure herself and was the sole judge of the acceptability of any answers given by the pupils. Although each teacher asked identical questions for each exercise, and possessed an identical set of correct responses, some variability undoubtedly occurred in the testing situations. Teacher expectancy, a questionable phenomenon which may affect the results of psychological research,[6] could also have had an unknown effect on the obtained results.

A final limitation is the type of school district. This factor severely limits the generalizability of the results to other schools, such as found in the inner cities.

TABLE I

Science A Process Approach Competency Measure Performance in Marple-Newtown Schools 1970-1971

Part E (Fourth Grade)

Exercise Letter	Number of Test Items	Number of Pupils Tested	Percentage of Correct Responses
a	13	38	82
b	10	40	82
c	4	38	81
d	9	34	78
e	8	42	83
f	9	30	73
g	4	40	82
h	3	38	89
i	4	34	80
j	4	40	87
k	6	38	73
l	6	42	83
m	3	38	78
n	6	38	83
o	4	38	86
p	6	34	89
q	7	20	87
r	5	38	89
s	4	34	88
t	4	32	80
u	3	32	80
v	6	28	90
w	7	24	67

TABLE II

Science A Process Approach Competency Measure Performance in Marple-Newtown Schools 1970-1971

Percentage of Correct Responses

Parts A through D

Exercise Letter	Part A	Part B	Part C	Part D
a	98	95	89	91
b	97	84	79	78
c	94	79	81	91
d	96	92	85	80
e	96	95	87	88
f	94	88	91	79
g	92	82	87	93
h	85	94	90	79
i	87	92	78	77
j	97	90	80	92
k	96	92	94	83
l	93	84	84	85
m	97	91	87	88
n	90	93	81	86
o	91	96	82	88
p	96	88	83	99
q	93	83	83	96
r	79	98	82	88
s	100	90	87	86
t	95	89	88	81
u	87	88	100	82
v	94	94	92	87
w	••	91	90	••
x	••	93	••	••
y	••	90	••	••
z	••	83	••	••
Number of Pupils Tested	438	1048	904	782

•• = no exercise

Conclusion

SAPA was originally designed so that 90% of the pupils should achieve 90% of the stated objectives. There has been no extensive published evaluation of the final version of Part E. The evaluation report of the experimental version indicated that Part E was less successful than Parts A through D.[7] This same trend can be observed in the final version of Part E in Marple-Newtown. The present figures, however, indicate that the objectives of the program are being achieved in the Marple-Newtown School District.

Figures for individual exercises indicate which exercises might need improvement--either in the teacher's guide itself or the questions that are asked of the pupil in the competency measure.

References

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3. Selected from Edwards, Allen L. Statistical Methods for the Behavioral Sciences. New York: Holt, Rinehart & Winston, 1954. Table I, pp. 472-4 6.

4. The investigator is Director, DElaware Valley Institute for Science Education (DEVISE), West Chester State College, West Chester, Pennsylvania.

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7. An Evaluation Model and Its Application, loc. cit.